

UTM's Role in the Development of Malaysian's Natural Resources Industries.

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Abstract

Malaysia is blessed with abundance of natural resources such as oil, natural gas, minerals and fertile soil for planting palm oil rubber, cocoa, timber and pepper. There is a bright outlook for the growth of both upstream and downstream industries based on natural resources in the country. The availability of skilled manpower and up-to-date technology are the important factors which determine the success of the industries. This paper highlights the role of Universiti Teknologi Malaysia (UTM) in developing the nation's natural resources industries especially in manpower training and research activities. A special emphasis will be given to the Faculty of Chemical and Natural Resources Engineering (FKKKSA) of UTM which is offering courses in petroleum, chemical, gas, polymer, bioprocess, and environmental engineering.

Introduction

Malaysia is blessed with abundance of natural resources such as oil, natural gas, minerals and fertile soil for planting palm oil rubber, cocoa, timber and pepper. There is a bright outlook for the growth of both upstream and downstream industries based on natural resources.

In the past, Malaysia exported most of the natural resources in the form of raw or semi-processed products. The trend has changed. The manufacturing and processing industries based on natural resources have been developed and currently are contributing towards the building up of the nation's economy. A great potential for further development is expected as Malaysia is progressing towards becoming an industrialised and developed nation by the year 2020.

In the petroleum industry there is at present a high level of activities both in upstream and downstream sectors. Malaysia is producing more than half a million barrels of crude oil per day. This represents almost sevenfold increase from 1974 when only 81,000 barrels of oil were produced. Similarly production of natural gas has increased more than sixfold from 272 million standard cubic feet per day (MSCFD) in 1974 to 1755 MSCFD in 1989 (1). In 1989 the export earning generated by oil and gas amount to \$11 billion or 16% of the country's total export earning. The number of oil companies currently operating in the Malaysian economic zones has also increased with

the participation of oil companies from various countries such as Taiwan, Japan, France, Great Britain, Australia, Canada and USA. The 'second oil boom' currently experienced by Malaysia reflects the increasing significance of petroleum industries.

Bigger investment is also being made in the Peninsular Gas Utilisation Project known as PGU 1 and PGU 2 (2). In PGU 2 gas pipeline from Terengganu is constructed down to Johor and Singapore and up along the west coast of the peninsular up to Penang forming adequate linkage between major industrial areas in West Malaysia. This project obviously will generate more spin-off industries especially in the manufacturing and processing sectors.

Investments in the petrochemical industry would be intensified in the next few years and it is expected that Malaysia will assume a significant role in the petrochemicals business in the east due to the country's proximity to the growing market (2). Between 1985 and 1990, the government has approved 266 projects involving total capital investment of about \$7.2 billion for the manufacture of chemicals and chemical products, petroleum and plastic products (3). The petrochemical industries are located in various places such as Kuantan, Pasir Gudang, Kerteh and Bintulu. Increased production for oil and gas demands higher capacity of oil refineries and gas processing plants. A big oil refinery is under construction in Melaka. Plan is also underway for the development of the sixth refinery in Kedah. The increased production of natural gas implies that bigger capacity of gas processing plant (GPP) be built. As a result GPP 2 will be built at Kerteh, Terengganu as an addition to GPP 1 currently operating. Similarly the Malaysian Liquefied Natural Gas (MLNG) plant in Bintulu, Sarawak will operate at maximum capacity. In the rubber sector, the government has set a consumption target of 300,000 tonnes to be achieved by the year 2000 (4). The rapid expansion of the palm oil industry in the last two decades has made it the most important agro-based industry in Malaysia (5). In 1981, palm oil export revenue has exceeded the export earning from rubber which until then was the main agricultural product.

As a university which specialises in science and technology, Universiti Teknologi Malaysia (UTM), is committed to ensure the progress of the technological development of the nation's natural resources industry. Technology is important to upgrade the natural resources to value added products and also towards developing new production methods. The most important role of UTM is to help in producing enough numbers of skilled and competent manpower for the industry. The other role which is equally important is in the field of research and development to develop new and better technology.

Man Power Training

The bright outlook for the growth of upstream and downstream industries based on natural resources in the country automatically raise question on the availability of skilled manpower in the country. Manpower availability is an important factor which determines the level of success in the industrial development programme. Due to this, there has been a major concern on the availability of the skilled manpower for the industry.

Table 1 summarises the percent annual increase of engineers by respective disciplines as targetted by the Industrial Master Plan (IMP) (6). As indicated in Table 1, Chemical Engineers shows the highest percentage of annual increase as compared to other disciplines. Also of interest to point out is the other disciplines which includes petroleum, gas, material or polymer with annual increase of 13.5 %. Overall the IMP report

envisage that a total of 47,371 skilled and semi-skilled manpower will be required by the end of 1995. This represents an additional increase of almost 300% from 1985 figure of 12,000. In order to meet the IMP target, the country has to provide 3,500 skilled and semi-skilled manpower annually. In the oil and gas sector, a total of 15,000 people are currently being employed. This number is expected to increase greatly in the coming years due to the new oil and gas projects.

The role of universities in the manpower training is very essential to the industries. Universities not only have to produce enough qualified graduates but also have to ensure that the education and training provided fulfill the needs of industries and the ever changing technology in the industrial sectors. Universities must therefore be aware of the development of recent technology.

UTM plays important role in supplying skilled manpower for the natural resources industries. In this paper, focus is given to the Faculty of Chemical and Natural Resources Engineering which offers courses in Chemical Engineering, Petroleum Engineering, Bioprocess Engineering, Gas Engineering, Polymer Engineering and Environmental Engineering. The graduates of the faculty had served in all major industrial sectors especially in oil and gas industries, chemical industries, manufacturing and process industries, food industries, palm oil industries, rubber based and agricultural based industries and pharmaceutical industries.

The faculty was established on the 15th of March, 1983 and consisted of two departments: Petroleum and Chemical Engineering Department. Two new departments have recently been formed in the faculty making a total number of 4 departments. The two new departments are:

1. Polymer and Gas Engineering Department
2. Bioprocess Engineering Department

The levels in which the courses are being offered are as follows:

Courses		Level			
1.	Petroleum Engineering	Dip.,	BSc,	MSc,	PhD
2.	Chemical Engineering	Dip.,	BSc,	MSc,	PhD
3.	Bioprocess Engineering		BSc,	MSc,	
4.	Gas Engineering		BSc		
5.	Polymer Engineering			BSc	
6.	Environmental Engineering				MSc,

The curriculum plays a very important role in determining the quality of graduates produced. Having realised this, UTM has taken a great care when formulating and implementing the curriculum so that the education and training provided fulfill the needs of industry and the ever changing technology.

The diploma course in Petroleum Engineering and Chemical Engineering takes 3 years or 6 semesters to complete. The first batch for the petroleum engineering students intake was in 1974 with 30 students per intake. The chemical engineering diploma course was introduced in 1983 and the student intake was recently increased from 30 per intake to 60. The students must complete a minimum of 94 credit hours before they can graduate. In the first year the main subjects are physics, chemistry, mathematics

and English while in the second year, basic engineering subjects like fluid mechanics, strength of materials, thermodynamics and introduction to petroleum engineering or chemical engineering are taught. For the third year students, subjects taught will be mainly on petroleum engineering or chemical engineering

For the degree course, the duration is 5 years or 10 semesters. In order to graduate the students must accumulate at least 150 credit hours. The credit hours on average for every semester is 15 hours (ranging from 12 to 18 hours). The contents of the curriculum can be divided in to seven groups. These are:

1. Physics, Chemistry and Mathematics
2. English
3. Religious Knowledge, Humanities and Malaysian affairs
4. Basic Engineering subjects
5. Subjects on Petroleum/ Chemical/ Gas/ Bioprocess/ Polymer Engineering
6. Group design projects and individual research project
7. Laboratory works and practical training

Core chemical engineering subjects are included in the Gas, Bioprocess and Polymer Engineering courses to widen the knowledge of the students. The specialised subjects of the Chemical, Gas, Bioprocess and Polymer Engineering courses are shown in Table 2.

The present curriculum has made compulsory for all degree students to undertake 1 semester industrial training. The normal industrial training venues for Petroleum Engineering students are Petronas, Sarawak Shell, Esso and Schlumberger while the Chemical Engineering students normally do their training in the chemical industries.

Final year students of the bachelor's degree programme is required to carry out project as a requirement for a bachelor's degree. For the Petroleum Engineering Department, the project represents an experiment or a study of a particular topic. For the Chemical Engineering Department, the students are assigned process design as their project. Representatives from Petronas, Sarawak Shell, EPMI, Schlumberger take part in the assessment field development projects and final year projects by the Petroleum Engineering students.

The Msc. programme offered in Petroleum and Chemical Engineering course are by research. However for students doing conversion courses, they are required to attend some courses in Chemical or Petroleum Engineering. Some of the research topics of the postgraduate students are shown in Table 3. For the M.Sc in Environmental Engineering degree, the program is run by coursework. The program requires a minimum of 32 credit hours including 6 credit hours of project work. The courses are offered in the evening and the program can be completed in three semesters. The program emphasizes assessments and solutions to environmental problems. Basic engineering and scientific principles are applied to analyse the production, transportation and effects of wide range of pollutants associated with modern technology.

The faculty is also active in continuing education programme by organising short courses, seminars and conferences. The short courses, seminars and conferences which has been organised by the faculty is shown in Table 4.

Research Activities

In the Faculty of Chemical Engineering and Natural Resources Engineering, the first research project was initiated in 1984 entitled 'Water Separation Using Crossflow Microfiltration Technique' with a grant of \$35,750 obtained from the Research and Consultancy Unit (UPP) of UTM. Until 1987 the development in research activities in the faculty was rather slow with only four projects. From 1988 onwards, however the activities have expanded tremendously and to date about 56 research projects have been approved with a total grant of about 7.1 million ringgit mostly from the UPP and Ministry of Science, Technology and Environment under the Intensification of Research In Priority Areas (IRPA) programme. A few research groups have been formed to accomodate these expanding activities. The research assistant and officers are encourage to register as postgraduate students whereby they could get masters or Ph.D degrees after completing the research. Some parts of these research projects are also given to the final year undergraduate students as their research projects. The active areas of research includes separation and filtration of palm oil, synthesis and usage of membrane for gas separation, reservoir characterisation, polymer modification and processing, bioprocess engineering, chemical reaction engineering and pollution monitoring and control. From the research work, many papers have been published and most of them were presented in seminars and conferences at national and international levels.

The laboratories in the faculty is well equipped with advanced analytical and testing equipments for research work. Currently, there are twenty laboratories in the faculty which are catogarised into analytical, processing, testing and characterisation, computer aided design, basic engineering and instrumentation.

Conclusion

UTM has contributed in manpower training and research activities. The paper has focussed on the role of the Faculty of Chemical and Natural Resources Engineering which has contributed by producing graduates in Chemical Engineering, Petroleum Engineering, Bioproses Engineering, Gas Engineering, Polymer Engineering and Environmental Engineering. The faculty is also active in research and development, with research grant allocated totalling \$7 million. Most of the research being conducted by faculty are in area related to natural resources such palm oil, petroleum and rubber.

References

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3. The Star, November 10th., 1989.
4. Government of Malaysia, Medium and Long Term Industries Master Plan - Manpower and Training, August 1985.
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TABLE 1 : Requirements of Engineers by Dicipline		
Dicipline	Number(1995)	Percent increase/yr
Chemical	1,087	17.1
Electrical	4,007	15.7
Mechanical	4,412	11.6
Civil	1,011	12.5
Others:		
Petroleum		
Gas		
Polymer/material	2,291	13.9

Table 2: Specialised Subjects for Gas, Polymer and Bioprocess Engineering Courses

Gas Engineering

Seminar
 Guel and Energy Technology
 Gas Transmission & Distribution
 Combustion Technology
 Fuel Testing Laboratory
 Gas system Laboratory
 Gas Storage & Transportation
 Combustion Laboratory
 Gas Processes
 Gas Utilisation
 Gas distribution Design
 Research project

Polimer Engineering

Advanced Chemistry
 Mass & Material Balance Projects
 Polymer Laboratory I
 Intro. Science & Polymer Eng.
 Properties of Polymer Eng.
 Latex and Rubber Technology
 Polymer Rheology& Processing
 Polymer Testing & Characterisation
 Polymer Laboratory II
 Polymer Laboratory III
 Mechanical Aspect of Polymer Eng.
 Research project

Bioproses Engineering

Biology Material
 Applied Microbiology
 Cell Physiology
 Microb Genetic
 Genetic Engineering
 Bioproses Engineering Laboratory I
 Fermentation Technology
 Genetic Engineering Laboratory
 Sterilisation Process
 Waste Treatment Technology
 Bioseparation
 Food Technology
 Material Science & Corrosion
 Bioprocess Engineering Lab II.

TABLE 3 : Masters and PhD. Research Topics

1. Application of Palm Oil Diesel as an Oil Based Drilling Mud Basic Fluid.
2. Formation Damage Due to Oil Based Drilling Fluids during Drilling Highly Deviated and Horizontal Wells.
3. Studies in the Separation of Solids from Diluted Crude Palm Oil Slurry by Filtration.
4. Crude Palm Oil Slurry Separation using Rotary Vacuum Drum Filter.
5. Fluid Distribution and Flow Behaviour in Non-uniform Wettability Porous Media.
6. Production of Hollow Fibre Membranes for Gas Separation - the Effect of Spinning Parameter.
7. Determination of Applicability of Dual Mode Sorption Theory in Separation of CO₂/CH₄ System at High Pressure.
8. Potential of using Membrane in the Purification of Crude Palm Kernel Oil.
9. Evaluation of the Suitability Of Locally Produce Cement as a Replacement for the Oilwell Cement.